DOCUMENT RESUME

ED 199 689 CS 005 988

AUTHOR Morgan, Argiro Louchis
TITLE Children's Inferential Comprehension of Pragmatic Causal Relations in Reading.
PUB DATE Apr 81
NOTE 58p.; Paper presented at the Annual Meeting of the American Educational Research Association (Los Angeles, CA, April 13-17, 1981).

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS *Cognitive Processes; *Context Clues; Discourse Analysis; Grade 4; Intermediate Grades; *Reading Comprehension; *Reading Research; Recall (Psychology); *Semantics; Sentence Structure; *Syntax
IDENTIFIERS *Inference Comprehension; Schema Theory

ABSTRACT

A study investigated the separate and combined effects of the syntactic organization of the sentence, the contextual framework in which a message is embedded, and the readers' past experiences on children's inferential reading comprehension of pragmatic cause/effect statements. The subjects, 144 fourth grade students, were asked to specify the implied event frames of target stimuli that varied in semantic difficulty, contextual presentations, and syntactic form. Results showed that without controls over short term memory, the majority of students responded correctly to literal questions. More correct responses were given to questions based upon the frequent experiences of children than to questions based upon their less frequent experiences. The data also indicated that fourth grade middle-class children of average or above average reading ability were quite successful in retaining and repeating upon questioning a surface repetition of a deleted syntactic form regardless of whether the causal relationship was stated explicitly or implicitly. The findings suggest that if target information is presented in isolation rather than embedded in text, literal recall is enhanced. (Materials used in the study are appended.) (GL)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED199689

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

Paper to be presented at the

AERA Annual Meeting, 1981

Children's Inferential Comprehension of Pragmatic Causal Relations in Reading*

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

Argiro Louchis Morgan

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Argiro Louchis Morgan

Department of Elementary Education

Xavier University of Louisiana

*The research reported herein is based on the author's doctoral dissertation submitted to the Graduate School of the University of New Orleans in partial fulfillment of the requirements of the Doctor of Education degree.

CS205988

Reading comprehension is presently conceptualized as a dynamic, complex cognitive operation in which information from a variety of independent sources interacts simultaneously to enable readers to generate tentative hypotheses about the meaning of a given text, hypotheses which can be accepted, rejected or refined as reading proceeds (Goodman, 1968; Rumelhart, 1975). Three potentially rich sources of information available to readers are the syntactic organization of the sentence, the contextual framework in which the message is embedded, and the reader's past experiences. The present study investigated the separate and combined effects of these three variables on children's inferential reading comprehension of pragmatic cause-effect statements.

REVIEW OF RELATED LITERATURE

Syntactic research on children's comprehension of causal relationships in reading has indicated that generally children can comprehend causal structures containing the connective "because" by the fourth grade. Robertson (1968) investigated the reading comprehension of seventeen coordinate and subordinate connectives by 402 fourth-, fifth-, and sixth-grade children of Canada. Robertson devised a "Connective Reading Test" as her dependent variable. Results indicated that comprehension of most connectives was related to both grade and ability level. Causal structures were among the easiest connectives of her sample to comprehend, although only 37% of the low-ability, fifth-grade

subjects of her study selected the correct answer for "because" test items.

Subsequently, the investigation of Bormuth, Carr, Manning and Pearson (1970) indicated that the selected causal structures containing the connective word "because" of their study were generally easy to comprehend. Questions using "because" to subordinate were answered correctly 83.3% of the time. McClure and Steffenson (1980) also found that, in a sentence completion task, structures containing "because" were generally easier to complete correctly than those involving the connective "and" or "but." The results of Pearson's investigation (1974-75) also indicated that third- and fourth-grade children of high and moderate reading ability had little or no difficulty responding to WH-questions after reading sentences containing causal relations expressed in eight structural variations.

Pearson (1974-75) was the first to suggest that the presence of an explicit connective could facilitate the comprehension of a connective relationship because it would make such a relationship explicit. He also suggested that the use of an explicit connective, which would result in a longer, more heavily embedded sentence, could facilitate comprehension because it would synthesize the lexical items and their relationships into a cohesive unit, which according to semantic integration theory might facilitate interpretation and recall. The results of Pearson's first experiment were somewhat ambiguous on the effect of

subordination on literal recall primarily because he made no attempt to control for short-term memory. However, a subsequent experiment did indicate that another small sample of fourth-grade children preferred a more heavily embedded structure marked by an explicit connective to a less cohesive, less heavily embedded form. Results of Pearson's investigation led him to question if the elimination of subordination or a reduction in sentence length automatically increased the readability of a sentence. However, a subsequent study by Standal (1976) found that fourth-grade subjects of average or better reading ability scored higher on the literal comprehension measures he employed when causal structures were phrased as two simple declarative statements regardless of whether the relationship was stated explicitly or implicitly. Unlike Pearson's study, clause order was not a variable in the Standal investigation.

Irwin's study (1978) using social studies materials, however, did not find causal relationships particularly easy to comprehend as did earlier investigations. In fact, Irwin's fifth-grade subjects had more difficulty comprehending sentences containing causal relationships presented in their reverse temporal order regardless of whether the relationship was stated explicitly or implicitly than sentences with a temporal sequence using the connective "after." In a subsequent study Irwin (1980) found the same difficulty with another fifth-grade sample. This investigation indicated that the presence of an explicit connective

seemed to facilitate comprehension in children, but that clause order did not appear to have any noteworthy effect. The follow-up study was replicated with 60 college subjects. Data from this replication indicated that adult subjects had considerably less difficulty comprehending target causal structures than did children, and that both explicitness and clause order were significant variables.

The research reviewed above on cause-effect structures focused exclusively the effect of certain syntactic arrangements on literal comprehension. Moreover, target structures utilized by Robertson (1968), Bormuth et al. (1970), Pearson (1974-75) and Standal (1976) were highly predictable from children's prior experiences. Irwin's findings (1978, 1980) seemed to indicate that when the causal statements refer to situations beyond children's ordinary experiences, even when stated explicitly in passage material, comprehension may be difficult. Irwin (1980) noted that the differences between the performance of her college-age subjects and her fifth-grade subjects may have been the result of different levels of prior knowledge rather than the result of different abilities to process causal relationships. Irwin (1980) herself stated that children's inferential comprehension of causal structures requiring different amounts or types of prior knowledge is a field for further research in this area.

It would appear self-evident that the comprehension of any cause-effect statement would depend upon vital semantic factors as

well as upon syntactic arrangements. A reader must be able to meaningfully interpret the given lexical items within a sentence, as well as their expressed or implied relationships within and between propositions. Determining the particular referents applicable to certain lexical items would be cued in part by the syntactic arrangements of those items within the sentence, but additionally by extra-sentential considerations, only some of which may be linguistic in nature. In other words, to be able to understand any given cause-effect sequence, both linguistic information as well as alinguistic knowledge must be used.

Moreover, cause-effect statements frequently require that an inferential chain (c.f. Thorndyke, 1976) be constructed so that the relationship between cause and effect propositions can be understood. Inferential chains, either forward or backward in nature, which are constructed by readers, may not be readily apparent because they are a natural occurrence in the comprehension of discourse. Some inferences may be logical in nature, as they involve the perception of an implied premise or logical conclusion from which is, in effect, a three-term syllogistic problem. For example, the following cause-effect statement

Because Socrates was a man, he was mortal.

implies the premise that all men are mortal. Other causal statements may require specific technical knowledge, without which the causal relationship is incomprehensible. For example, to understand the statement

Because the F-calculated was 1.0, the hypothesis was not rejected.

the reader would have to have access to the knowledge that an F-ratio of 1.0 in analysis of variance statistical analysis can never, in practice, be significant. Inferences evoked by cause-effect statements in narrative material in most instances are based upon implicit world knowledge. For example, to comprehend the following sentence

Because the running back was clipped, the team was penalized.

requires that the event-frame of a football game be evoked in order that the proper meanings can be assigned to unclear lexical items, namely, running back and clipped. Inferences such as the latter are pragmatic in nature because they are based upon prior knowledge with the physical world. Pragmatic inferences make discourse coherent, cohesive, and ultimately comprehensible. Sentence comprehension, therefore, depends in large part upon the prior knowledge of readers, knowledge which is cued frequently by the context of the sentence.

A number of researchers have demonstrated that the meaning of a sentence and its recall depends upon the knowledge structures to which it is related (Bransford & Johnson, 1973). One experiment demonstrating the interrelationship of prior knowledge, context, and linguistic input was reported by Bransford and McCarrell (1974). This experiment showed the importance of access

to unifying event-frames upon the recall of certain cause-effect statements. Target stimuli were devised requiring an inference regarding the situation in which a causal relation could make sense. Without an understanding of the context of the causal relation, half of the sentences were difficult to understand. The other half implied situations more easily accessed. For example, an easy sentence was as follows:

The car was moved because he had no change.

A difficult sentence of the study was

The haystack was important because the cloth ripped.

Results of the study indicated that easy sentences were recalled readily only if no event-frame was specified for each sentence on study trials. If all the sentences wre preceded by a context cue, such as parking meter and parachutist for the sentences given above, differential recall of easy and difficult sentences did not occur.

The investigation reported by Bransford and McCarrell used adults as subjects. Most research involving semantic prerequisites to the comprehension of difficult-to-understand prose have involved adult subjects. To date very few have been published utilizing children as subjects (e.g. Brown, Smiley, Day, Townsend & Lawton, 1976; Pearson, Hansen & Gordon, 1979). Moreover, some studies have indicated that although children do make inferences as they comprehend language (Paris & Carter, 1973; Kail, Chi,

Ingram & Danner, 1977; Blachowicz, 1977-78; 1978-79), developmental trends exist in the use of information to construct an elaborated memory representation, and to understand and recall inferred relations between the ages of six and eleven (Paris & Upton, 1976).

The present study using fourth-grade subjects was designed, therefore, to furnish data on the ability of fourth-grade children to make pragmatic inferences from text involving specific cause-effect relationships. The target structures were designed specifically to reflect different levels of prior knowledge as they invited the reader to construct inferentially the event-frames pertaining to the structure of interest. The study asked how readily do children of ages nine and ten answer correctly questions based upon data not explicitly stated in text, and to what extent can children benefit from specific types of context to activate previously acquired experiences relevant to the meaningful interpretation of unspecified or unclear referents. At the same time, the effect of syntactic variations involving the presence of an explicit causal connective and of sentence length was also explored. In short, the present study investigated the effect of certain semantic, contextual, and syntactic variations on the ability of children to make inferences from text dealing with cause-effect pragmatic relationships.

THEORETICAL FRAMEWORK

Semantic integration theory supporting an interactive model of the reading process formed the study's theoretical base. According to semantic integration theory, a person's world knowledge, internalized in abstract semantic networks known as schemata, interacts with the context and the linguistic characteristics of a given message to determine its meaning. Comprehension occurs as a joint function of input information and of prior knowledge, and requires an active cognitive contribution on the part of the language receiver.

Semantic integration denies that a purely transformational analysis characterizes all the information available to a language receiver, and views sentences as cues which can be utilized to construct semantic descriptions of events, situations, or states consistent with the information specified in a given sentence (Bransford, Barclay & Franks, 1972). Preexisting abstract knowledge structures or schemata incorporating a subject's previous experience with the world are employed by readers in their constructive interpretations of texts. These hierarchially encoded mental representations facilitate the storage of information--both linguistic and alinguistic, furnish a heuristic organization for such information, and help in the retrieval of information from long-term memory (Adams & Collins, 1977; Anderson, R. C., 1977; Canney & Winograd, 1979; Spiro & Tirre, 1979; Thorndyke, 1975).

The theoretical framework of the study led to the following suppositions which were formulated into research questions:

1. that a given text would be difficult to comprehend if a reader could not access the schema that subsumes it;

2. that a contextual setting--visual or linguistic--would facilitate the comprehension of a difficult-to-understand sentence by providing a situation or event-frame whereby a relevant schema could be applied to the interpretation of the sentence;

3. that a more highly cohesive, integrated syntactic structure with an explicit connective could facilitate the comprehension of a linguistic message, even though such a sentence would be longer and transformationally more complex than two simple sentences.

PURPOSE OF THE STUDY

The purpose of the study was to investigate the effects of specific semantic, contextual, and syntactic variations on children's inferential reading comprehension of pragmatic cause-effect statements. The three independent variables were varied systematically in a set of sentences and paragraphs in order to assess their separate and combined effects on one dependent variable--the subject's inferential comprehension of pragmatic causal statements.

To accomplish the purpose of the study, answers to the

following research questions were sought.

1. What are the effects of the relative semantic difficulty of the relationship specified in the target structure on children's inferential comprehension of cause and effect relationships?

2. What are the effects of isolation or contextual presentation on children's inferential comprehension of cause and effect relationships?

3. What are the effects of two types of syntactic variation on children's inferential comprehension of cause and effect relationships?

4. What interactions between or among the variables affect children's inferential comprehension of cause and effect relationships?

PROCEDURES

Construction of Materials

Forty-eight cause-effect statements modeled after causal structures reported by Bransford and McCarrell (1974) were constructed to invite inferences pertaining to their event-frames. The causal relationships contained in the target structures were pragmatic in nature; that is, they could be understood based on previous experience with the physical world. The causal clause referred to an observable event or to an observable descriptive state; the effect clause referred to an observable event.

Psychological states were not utilized as elements of either cause or effect clauses. State-to-state sequences such as "Because he was gloomy, his teacher became concerned," and event-to-state sequences such as "Because the field goal was missed, the crowd was disappointed" were not included in the materials of the study. The 48 sentences originally constructed to be piloted with adult subjects can be found in Appendix A of this paper.

In order to group the sentences into two global levels of difficulty--sentences relatively easy to interpret, and sentences relatively difficult to comprehend, the 48 sentences were piloted on 100 adult subjects. Subjects were asked to indicate whether each sentence was easy or difficult to understand, as well as to specify the situation which would clarify each sentence. Inferences regarding the event-frames were scored for acceptability, and a frequency count of ratings was also computed. The judgment of three independent adults was used before a final determination of acceptable inferential responses of certain items was made. On the basis of data from the pilot study, a number of structures were selected for development into passages.

Passages were constructed with vocabulary of fourth-grade reading difficulty using Dale and O'Rourke's Living Word Vocabulary (1976) as reference, and had approximately the same number of words per T-Unit, and approximately the same number of T-Units per passage. Passages were read by professional colleagues, adults, and children and revised when needed. Position of the

target structure and its effect on the coherence and unity of the paragraph, as well as other rhetorical and semantic considerations played important roles in the final selection of the twelve structures to be used in the primary study with children. Of the twelve selected, four passages contained the target structure near the beginning of the paragraph, four approximately in mid-position and four toward the end. The placement was distributed equally between the two global levels of difficulty within the semantic way. The paragraphs contained clues to help readers infer the situation implied by each cause-effect statement. The passages did not, however, explicitly state the event-frame under question.[3]

The twelve target structures selected for the primary study with children grouped according to the two global levels of difficulty of the semantic way are as follows:

SEMANTICALLY EASY STRUCTURES

1. Because the passengers were taking off, all seat belts were fastened. (Airplane)
2. Because the sign read CLOSED, the children didn't get any ice cream. (Ice Cream Store)
3. Because the needle was old, the music was scratchy. (Phonograph or Stereo)
4. Because the horse stopped in mid-air, the child had to climb down. (Carousel)
5. Because the coin did not fit into the slot, the child did not get his snack. (Vending Machine)

6. Because the trunk was long, the peanut could be reached. (Elephant)

SEMANTICALLY DIFFICULT STRUCTURES

1. Because the seam split, the note was sour (Bransford & McCarrell, 1974). (Bagpipe)

2. Because the bottle broke, the trip was not delayed (Bransford & McCarrell, 1974). (Ship Christening)

3. Because Tom's heel was too low, he lost the award. (High Jump)

4. Because Don's elbow was raised, the contest ended. (Arm Wrestling)

5. Because the wind blew strongly, Mike pulled back. (Kite)

6. Because the window was wide open, the little colored shapes moved. (Mobile)

The causal target structures were presented in three possible contexts: in isolation, in isolation preceded by a picture designed to activate a schema, or in paragraph form. There were thus three levels of the contextual variable. Pictures were simple line drawings. A sample of the pictures and passages for two of the target structures can be found in Appendices B and C of this paper.

The cause-effect structures were phrased in one of two different syntactic forms:

1. Two sentences, without the presence of an explicit

causal connective, as illustrated by the following sentence:

The sign read CLOSED. The children didn't get any ice cream.

2. A single, complex sentence, with an explicit causal connective present, as illustrated by the following sentence:

Because the sign read CLOSED, the children didn't get any ice cream.

All target structures were organized in terms of a chronological cause-effect sequence. Clause order was not a variable in the study, as in investigations by Pearson (1974-75) and Irwin (1980).

Measuring Instruments

The Inferential Measure. WH-type interrogative sentences were designed to specifically elicit the inference regarding the situation pertaining to each target structure. These questions served as the dependent variable of the study. The questions varied somewhat syntactically from target structure to target structure, and in some cases from contextual condition to contextual condition because there was no one form that could elicit the implicit comprehension of a structure for all passages and for all contextual conditions. Answers to inferential questions following a passage or a picture had to pertain to the given situation described in the passage or graphically illustrated by

the picture to be counted as correct.

Answers to inferential questions following sentences in isolation, however, did produce some divergent responses. If a subject made a logically or empirically acceptable inference regarding the situation in which the event could have occurred, even though it may be differed from the researcher's intent, the subject's response was judged correct. An independent trained rater was used to verify the objectivity of the measure. The percentage of agreement between the independent rater and the researcher was .99.

The Literal Measure. A literal measure was employed for descriptive purposes in order to compare the results of the study with previous reading investigations of cause-effect syntactic structures using a similar measure as the dependent variable (Pearson, 1974-75; Standal, 1976). Without specific controls over short-term memory, the literal measure could not furnish any information regarding the subjects' use of prior knowledge of the world to interpret inferentially the target structures of the study. In order to make the experimental task similar to school test-like experiences, and in order to avoid taxing the attentional skills of the nine- and ten-year-old subjects of the study, short-term memory controls were not employed. The following procedure was followed to construct literal questions.

A "why" transformation for deriving a question to assess literal comprehension of target structures was accomplished by

omitting the causal clause in the target structure and replacing it with "why" followed by the effect clause. This procedure was described by Bormuth (1970) and Menzel (1970) and used by both Pearson (1974-75) and Standal (1976). This procedure was applied to each target structure regardless of the syntactic variation in which it appeared in stimuli material and of the contextual condition in which it was presented.

If the subject correctly identified the specific syntactic element deleted by the WH-question transformation, or furnished a reasonable paraphrase, one point was given on the literal measure. Logically or empirically acceptable inferences regarding the situation or conditions pertaining to the causal statements were scored as correct, but a frequency count of such instances grouped according to the contextual condition in which it was forthcoming was made. An independent trained rater was used to assess the objectivity of the scoring.

All materials used in the final study were piloted with fourth-grade children and modified on the basis of the pilot study before the final investigation was undertaken.

Design of the Study

A three-way factorial repeated measures design was utilized. The design matrix is presented in Figure 1.

Insert Figure 1 about here.

Each possible combination of semantic topic, contextual condition, and syntactic variation formed a unique cell in the design. The design consisted of 72 cells.

Each target structure could be stated in two possible syntactic forms. The label C was selected arbitrarily to represent the syntactic variable, and the two possible syntactic variations were assigned the following numbers:

C1 Two simple sentences without an explicit causal connective

C2 A complex sentence with an explicit causal connective

Each target structure could appear in three possible contextual conditions. The label B was selected to represent the contextual variable, and the following numerical values were assigned to the three contextual conditions:

B1 Target structure in isolation

B2 Target structure preceded by a picture

B3 Target structure embedded in a paragraph

Label A was arbitrarily assigned to represent the semantic variable. The twelve topics selected for the study were assigned the following codes:

A01 Airplane (Easy)

A02 Ice Cream Store (Easy)

A03 Phonograph/Stereo (Easy)

A04 Carousel (Easy)

A05 Vending Machine (Easy)

A06 Elephant (Easy)

A07 Bagpipe (Difficult)

A08 Ship Christening (Difficult)

A09 High Jump (Difficult)

A10 Arm Wrestling (Difficult)

A11 Kite (Difficult)

A12 Mobile (Difficult)

The pilot study had indicated that the first six semantic fields were easier to access than the remaining six. Therefore, the first six structures represented Level I of the semantic way, and the remaining six Level II. Each possible combination of semantic topic, contextual condition, and syntactic variation formed a unique cell in the design. Each subject was measured 12 times. Subjects were exposed to each semantic field in each surface form in each contextual condition only once. Thirty-six unique combinations of 12 cells each were identified to insure that the combinations of repeated measures completed by the subjects were balanced across levels. For example, the first order was as follows:

A01B1C1 A02B1C2 A03B2C1 A04B2C2 A05B3C1 A06B3C2

A07B1C1 A08B1C2 A09B2C1 A10B2C2 A11B3C1 A12B3C2

The next subsequent order rotated the semantic content in the following manner:

A01B1C1 A02B1C2 A03B2C1 A04B2C2 A05B3C1 A06B3C2

A08B1C1 A09B1C2 A10B2C1 A11B2C2 A12B3C1 A07B3C2

Each of the 72 cells of the design appeared in six of the 36 semantic content rotations. Four subjects were assigned at random to each of the 36 semantic content rotations. Since each cell was contained in six of the rotations, and four subjects were assigned to each rotation, data was gathered from 24 subjects for each of the 72 cells of the matrix. Twelve of the 24 subjects furnishing data for each cell were boys; the remaining 12 subjects were girls. Additionally, each booklet's content was presented in a unique randomly-determined order. Test booklets were collated by computer and printed with the margins justified on both sides of the page. This was done to maximize the ecological validity of the study. Each stimulus condition was placed on one separate page and was followed by questions on the next page.

Subjects of the Study

One hundred forty-four middle-class fourth-grade children attending eight suburban schools within a 100-mile radius of a major Southern metropolitan area were subjects of the study. The subjects were randomly selected from a list of fourth-grade pupils who had attained a composite grade level score in reading on their latest achievement test administered by their respective schools of not less than five months below grade placement, and who had received written permission from their parents or guardians to participate in the study. The 72 boys and 72 girls in the sample ranged in age from 9 years 1 month to 10 years 3

months with a mean of 9 years 9 months. Composite reading scores of the subjects ranged from 4.3 to 9.9 with a mean of 6.6. The standard deviation of the distribution was 1.6. The coefficient of skewness was .210. These values indicate that the sample was composed of better than average readers for their age and grade placement.

Testing Procedures

Data were collected in small group sessions. The children were told that the investigator was conducting a study to see how readers read and understand certain sentences and paragraphs. The children were told that spelling need not be a concern when responding to questions, and that if any word could not be read, they were permitted to ask for assistance. Each group of children worked together three practice items in test booklets before beginning test items. All children began the test items at the same time. No subjects had to be replaced because of difficulty with word recognition, or because of inattention to the task.

RESULTS OF THE STUDY

Overview of the Analysis of Data

The means of the correct responses to both literal and inferential questions were determined for each of the 72 cells of the study. Tables 1, 2, 3, and 4 indicate the values of this descriptive analysis.

Insert Tables 1, 2, 3, and 4 about here.

Additionally, the means of inferential information contained in answers to literal questions were determined and grouped according to the three levels of the contextual variable. Data from this analysis is presented in Table 5.

Insert Table 5 about here.

A preliminary one-way analysis of variance using a priori polynomial contrasts verified that the order of measurements did not affect the results. This is a necessary condition for performing a repeated measures analysis. Subsequently, a three-way repeated measures analysis of variance was performed to answer the research questions of the study. Table 6 reports the results of the three-way repeated measures analysis of variance. The level of significance chosen was the .05 level of probability.

Insert Table 6 about here.

Main Findings

The findings listed below correspond to the research questions of the study. Data from the inferential questions, analyzed by analysis of variance appropriate for a three-way factorial repeated measures design, indicated that:

1. The relative semantic difficulty of the pragmatic causal statements significantly affected the subjects' ability to specify the event frame implied by the target structure ($p < .01$); as Tables 1 and 2 show, the mean of correct responses for semantically easy structures was .864, whereas the mean of correct responses for semantically difficult structures was .367. Table 6 indicates that the difference between these means was significant beyond the .01 level of statistical significance ($F = 659.03$, df = 1,1563).

2. A picture from which the implied context could be interpreted facilitated the subject's ability to answer correctly the inferential questions of the study. As Tables 1 and 2 indicate the means for the target structures for the three levels of context were as follows:

Context 1 (Isolation) : $\bar{X} = .474$

Context 2 (Picture) : $\bar{X} = .738$

Context 3 (Paragraph) : $\bar{X} = .634$

Table 6 indicates that the difference between the means of Context 1 and Context 2 conditions was significant beyond the .01 level of statistical significance ($F = 123.13$, df = 1,1563).

To test the effect of paragraph format on the subject's ability to specify the correct event-frame of the target structure, the mean of the Context 3 condition ($\bar{X} = .634$) was compared statistically to the means of all correct inferential responses given to target structures presented in the other two contextual

conditions. (e.g. $\bar{X}_3 = \bar{X}_1 + \bar{X}_2 / 2$). Table 6 indicates that the F-calculated ($F = 1.64$, df = 1,1563) was less than the F-critical needed to reject the null hypothesis at the .05 level of statistical significance. In order to test post hoc null hypotheses that $\bar{X}_1 = \bar{X}_3$ and that $\bar{X}_2 = \bar{X}_3$, Scheffe post hoc contrasts were computed. Neither pair of means reflected a statistically significant difference.

3. No statistically significant effect was found for the syntactic variable. As Tables 1 and 2 indicate, the mean of correct responses for target structures phrased as two simple sentences without an explicit causal connective was .60o; the mean of correct responses for target structures phrased as one complex sentence with an explicit causal connective was .625. Table 6 indicates that the two means were not significantly different at the .05 level of statistical significance (F = 1.32, df = 1,1563).

4. Table 6 indicates one significant interaction: that of semantic content difficulty by the first context contrast ($F = 44.32$, df = 1,1563, $p < .01$). Preceding an isolated causal statement by a picture resulted in an improved performance by subjects on the inferential measure used in the study, but a more drastic improvement occurred when causal statements especially difficult to interpret were preceded by a presumably disambiguating or schema-evoking picture than when the statements were more easy to interpret. Figure 2, a graphic plot of the means, shows

that

Place Figure 2 about here.

the context in which target structures are presented makes the most difference when the structures are semantically difficult. The easy structures tended to be easy regardless of context. The most dramatic differences occurred between easy and hard structures presented in one sentence context, and when a difficult structure was presented either alone with a picture or embedded in a paragraph.

A descriptive analysis of the data from the literal measure indicated that:

1. The total mean of correct answers to literal questions for the easy structures was high ($\bar{X}$ = .943) with little or no variability among passage topics, context or syntax (See Table 3). The total mean of correct answers to literal questions based upon difficult-to-interpret structures was somewhat lower than that obtained from literal questions to semantically-easier target structures ($\bar{X}$ = .819), as indicated by Table 4.

2. Table 3 indicates that the means of correct responses to the literal measure based on easy structures differed little among the three contextual conditions. Table 4 shows that the number of correct responses to literal questions based on difficult structures was slightly reduced if the structure was embedded in paragraph form ($\bar{X}$ = .723) rather than when presented in

isolation ($\bar{X}$ = .859) or preceded by a picture ($\bar{X}$ = .877). However, more inferential information was contained in literal answers when the questions followed structures presented with additional context as Table 5 indicates.

3. In general, the means for the two syntactic conditions varied little, although there were some passage-specific variations.

DISCUSSION

Results of the Literal Measure

The results of the study indicated that without controls over short-term memory, the majority of subjects responded correctly to literal questions, although more correct responses were given to questions based upon frequently-encountered experiences of children than to questions based upon less frequently-encountered experiences. The data also indicated that fourth-grade middle-class children of average or above-average reading ability are quite successful retaining and repeating upon questioning a surface repetition of a deleted syntactic form regardless of whether or not the causal relationship was stated explicitly or implicitly. The results were therefore similar to those obtained by Pearson (1974-75) who observed in his first experiment virtually perfect performance to causal structures presented as stimuli.

Data from the present study suggested that if target

information is presented in isolation rather than embedded in paragraphs, literal recall is facilitated. This result was expected since short-term memory controls were not employed. The results corresponded to those of Standal (1976), although he found larger differences in response accuracy between the isolation and the paragraph condition.

The constructive theory of comprehension would predict, however, that old information from the subjects' previous experience united with the new information in the stimuli would generate some answers going beyond that explicitly stated. In spite of the fact that no controls were employed for short-term memory, some answers to literal questions did include facts, settings, or judgments not explicitly stated in the omitted cause clause. Table 5 indicated that some spontaneous inferential material was contained in literal responses based on every semantic field of the study, with more forthcoming from semantically-easy structures than from semantically-hard structures. In fact, 25% of the correct answers to literal questions based upon semantically-easy structures included some form of a spontaneous inference, while 15% of the correct answers to literal questions to semantically-difficult structures included some type of spontaneous inference. These results corresponded with those of Standal. In addition to measuring the accuracy of the answers of his subjects, Standal employed a congruence measure to determine the exact lexical and syntactic

correspondence between the deleted causal clause and the written responses of his subjects. He found that isolated stimuli elicited significantly more congruent responses than did structures embedded in paragraphs. Findings from the present study suggested that more additional information was present in children's literal responses when target information was embedded in context, particularly in paragraph form. These findings are in keeping with semantic integration theory which would predict that the additional information contained in paragraphs would interact with previously existing experience to trigger constructive additions to texts.

Findings from the present study indicated that the syntactic factors of explicitness and of sentence length had no effect on the ability of children to answer the literal questions of the study.

Results of the Inferential Measure

Results of the study indicated that comprehension does not depend on the ability to pronounce given lexical items, nor to recall them in their particular syntactic arrangement. Subjects of this study were able to accomplish both these tasks easily, even when they were unable to identify the situation or event-frame which would make the target structures understandable. The results indicated that, if the referent to a specific lexical item is unclear, or if a specified relationship is vague,

comprehension is enhanced when relevant, previously existing knowledge, presumably encoded in schemata, can be accessed for interpretation. Providing a situation or an event-frame for a given sentence increased the probability that a relevant schema could be applied for the interpretation of difficult-to-understand causal statements. On the other hand, if the target structure referred to experiences frequently encountered by children, and presumably encoded in well-formed schemata, little difficulty was experienced in interpreting the situation pertaining to the implied content of the target structure. Results were similar to other investigations based on schema theory which used adults as subjects (e.g., Anderson & Pickert, 1977; Anderson, Reynolds, Schallert & Goetz, 1976; Collins, Brown & Larkin, 1977; Pickert & Anderson, 1976; Schallert, 1975; Spiro, 1975; Steffenson, Joag-dev & Anderson, 1978; Sulin & Dooling, 1974).

Results of the study supported the view that context plays a major role in the comprehension of text. The findings suggested that middle-class, fourth-grade children can employ contextual information to evoke a long-term memory representation which facilitates their understanding and recall of causal relationships with non-specified event-frames. As in the research with adults by Bransford and Johnson (1972), pictures were found to be especially effective to evoke frameworks or schemata whereby discrete events found in prose can be integrated and understood. The findings were in keeping with the data reported by Haring and

Fry (1979) which indicated that pictures serve an integrative function to facilitate the comprehension of information presented in prose. The findings also suggested that linguistic cues presented in paragraph format in which a target structure is embedded can assist children in their construction of an event-frame or schema by which a pragmatic causal structure can be comprehended.

Findings relative to the syntactic variable offered little support to the suggestion that the presence of a connective word in the surface structure of a sentence would facilitate the comprehension of the relationship indicated by the connective word and the concepts connected by that connective. Findings pertaining to the syntactic variable additionally did not support a readability hypothesis, i.e. the position that shorter sentences are easier to comprehend than longer sentences. Although Standal's study (1976) had indicated that two short sentences without the presence of an explicit connective resulted in higher scores according to the criteria he employed to assess literal comprehension, it was expected that the comprehension of inferential causal relationships would depend more heavily on semantic factors than syntax. This finding should not be construed to suggest that syntax does not play a role in reading comprehension. It merely indicated that the syntactic variation employed in this investigation was understood by children, and that, if a

particular syntactic construction has been mastered, semantic and contextual factors play more important roles in the comprehension of a given message.

The findings suggest that semantic integration theory correctly portrays language as a set of cues which a reader can utilize to construct meanings applicable to a given text. Semantic and contextual factors were the significant main effects of the investigation. The data suggested that comprehension is a dynamic, interactive, constructive process whereby the reader brings experiences to the printed page to comprehend a written message.

IMPLICATIONS FOR TEACHING

The present study attempted to address issues that relate indirectly to classroom practice. These findings suggest that schemata pertaining to a given topic or a particular passage should be ascertained and developed if students are to be expected to fully comprehend, retain and apply the concepts located in prose material. Pre-reading activities would be particularly important in the content areas where the concept load is high.

The findings also suggest that a skills approach to the teaching of reading may not be fully appropriate. Some skill approaches presume that components of the reading act can be logically analyzed into a sequential hierarchy of discrete skills. Such linear models of reading instruction traditionally assume

that inferential questions are inherently more difficult than literal questions. The findings of the present investigation suggested, however, that although inferential questions are somewhat more difficult for children than literal questions, when children bring to the reading task previous experiences related to textual information, pragmatic causal inferences can be made with little difficulty. As Tables 1 and 3 indicate, the means of correct responses based on semantically-easy target structures did not differ considerably between literal questions ($\bar{X}$ = .943) and inferential questions ($\bar{X}$ = .819). On the other hand, Tables 2 and 4 show that the means of correct responses based on semantically difficult target structures varied considerably between literal questions ($\bar{X}$ = .819) and inferential questions ($\bar{X}$ = .367). The study therefore suggests that inferential questions appear to be more difficult than literal questions if relevant previous experiences are difficult to access. The findings of the present study support the position of Paris (1975), Thorndyke (1976) and Spiro (1975) that the inferential process is a natural occurrence in the comprehension and integration of information contained in text. Support for that position can also be found by the fact that many answers to literal questions contained inferential information in the present investigation.

The findings help explain why children who bring to the reading task extensive and deep experiences can understand more fully, and can recall prose information more easily from a text

than students with less extensive experiences. Finally, the findings also help explain why divergent interpretations of the same text are made. For a variety of personal and/or socio-cultural reasons, an inappropriate framework or a divergent schema may be applied to the interpretation of instructional material.

In fact, such misinterpretations might even be referred to as comprehension "miscues," borrowing a term developed by Goodman (1976). Goodman defined "miscues" as any oral deviation from a printed text. Oral "miscues," according to Goodman, should not be regarded as "errors," but as indicators of the processes readers use to obtain meaning from the printed page. Oral "miscues" may differ in quality, and can be analyzed to cast light on how a reader processes text in terms of the phonological, syntactic, and semantic systems of language.

A comprehension "miscue" might be defined as any response to a comprehension question which does not match the teacher's expectations. Such comprehension "miscues" may also differ in quality. Some may occur because the student has approached a given text with a schema based on unique experiences that differ from those of the author or from those of the teacher. Such comprehension "miscues" can also be analyzed to reveal how the past alinguistic experiences of the learner affects the reader's search for meaning from the printed page.

In summary, the findings of the present investigation

suggest that pragmatic, causal inferences can occur more readily if children bring to the reading task background experiences pertaining to a given topic. The findings suggest that instructional activities prior to the development of specific content may be essential in order to facilitate the comprehension process. The findings also help explain why divergent interpretations to the same text may be made by students of differing backgrounds, and why some reading material can be decoded but not fully understood.

Recommendations for Further Research

The present study suggests that syntactic studies on reading comprehension are best conducted within a model of the reading process stressing the interactive, dynamic nature of comprehension. Semantic aspects of such studies could be more precisely delineated, and a variety of different contextual influences upon comprehension investigated. The influence of a picture depicting the event-frame or setting of a narrative passage on comprehension is a specific question posed by the present study.

A significant body of research with adults has been conducted on the influence of prior experience on linguistic processing. Additional studies need to be conducted with children as developmental differences should be reflected in results of such investigations. The effect of differing sociocultural

backgrounds on the reading comprehension of passages embodying prior knowledge of events of cultural significance, the effect of prior knowledge on the reading comprehension of specific topics in the content areas, the relationship of learning styles to schema utilization and the relationship of creativity to the ability to evoke a synthesizing schema capable of interpreting ambiguous passages are possible areas of further exploration. Different measures of comprehension also could be employed in subsequent studies that would perhaps furnish additional data on the processing strategies children employ to interpret difficult-to-understand prose.

Additionally, investigations should be undertaken as to the most effective techniques which could be used in the classroom to develop readiness for specific topics, and to develop inferential reading skills.

References

Adams, M. J., & Collins, A. A schema-theoretic view of reading comprehension. (Tech. Rep. No. 32). Urbana, Ill.: The University of Illinois, April, 1977.

Anderson, R. C. Schema-directed processes in language comprehension. (Tech. Rep. No. 50). Urbana, Ill.: The University of Illinois, Center for the Study of Reading, July, 1977.

Anderson, R. C. & Pichert, J. W. Recall of previously unrecallable information following a shift in perspective. (Tech. Rep. No. 41). Urbana, Ill.: The University of Illinois, Center for the Study of Reading, April, 1977.

Anderson, R. C., Reynolds, R. E., Schallert, D. L., & Goetz, E. T. Frameworks for comprehending discourse. (Tech. Rep. No. 12). Urbana, Ill.: The University of Illinois, Center for the Study of Reading, July, 1976.

Blachowicz, C. L. Z. Semantic constructivity in children's comprehension. Reading Research Quarterly, 1977-78, 13, 188-199.

Blachowicz, C. L. Z. Factors affecting semantic constructivity in children's comprehension. Reading Research Quarterly, 1978-79, 14, 165-181.

Bormuth, J. R. On the theory of acheivement test items. Chicago: The University of Chicago Press, 1970.

Bormuth, J. R., Carr, J., Manning, J., & Pearson, P. D. Children's comprehension of between- and within- sentence

syntactic structures. Journal of Educational Psychology, 1970, 61, 349-357.

Bransford, J. D., Barclay, J. R., & Franks, J. J. Sentence memory: A constructive versus interpretive approach. Cognitive Psychology, 1972, 3, 193-209.

Bransford, J. D., & Johnson, M. K. Contextual prerequisites for understanding: Some investigations of comprehension and recall. Journal of Verbal Learning and Verbal Behavior, 1972, 11, 717-726.

Bransford, J. D., & Johnson, M. K. Consideration of some problems of comprehension. In W. Chase (Ed.), Visual information processing. New York: Academic Press, 1973.

Bransford, J. D., & McCarrell, N. S. A sketch of a cognitive approach to comprehension: Some thoughts about understanding what it means to comprehend. In W. G. Weimer & D. S. Palermo (Eds.), Cognition and symbolic processes. Potomac, Md.: Erlbaum Press, 1974.

Brown, A. L., Smiley, S. S., Day, J. D., Townsend, M. A. R., & Lawton, S. C. Intrusion of a thematic idea in children's comprehension and retention of stories. (Tech. Rep. No. 18). Urbana, Ill.: The University of Illinois at Urbana - Champaign, December, 1976.

Canney, G., & Winograd, P. Schemata for reading and reading comprehension performance. (Tech. Rep. No. 120). Urbana, Ill.: The University of Illinois, Center for the Study of Reading, April, 1979.

Collins, A., Brown, J. S., & Larkin, K. M. Inference in text understanding. (Tech. Rep. No. 40). Urbana, Ill.: The University of Illinois, Center for the Study of Reading, December 1977.

Dale, E., & O'Rourke, J. Living Word Vocabulary: A 43,000 Word Vocabulary Index. Elgin, Ill.: Dome Press, Inc., 1976.

Goodman, K. S. The psycholinguistic nature of the reading process. Detroit: Wayne State University, 1968.

Goodman, K. S. Miscues: Windows on the reading process. In K. S. Goodman (Ed.), Miscue Analysis: Applications to reading instruction. Urbana, Ill.: National Council of Teachers of English, 1976.

Haring, M. J., & Fry, M. A. Effect of pictures on children's comprehension of written text. Educational Communication and Technology Journal. 1979, 27, 185-190.

Irwin, J. W. The effects of the interaction of syntactic complexity and the explicitness of connective propositions on fifth graders' comprehension of prose. Doctoral dissertation, University of Wisconsin-Madison, 1978. (University Microfilms No. 78-20,627).

Irwin, J. W. The effects of explicitness and clause order on the comprehension of reversible causal relationships. Reading Research Quarterly, 1980, 15, 477-488.

Kail, R. V., Jr., Chi. M. T. H., Ingram, A. L., & Danner, F. W. Constructive aspects of children's reading comprehension.

Child Development, 1977, 48, 684-688.

McClure, E., & Steffensen, M. S. A study of the use of conjunctions across grades and ethnic groups. (Tech. Rep. No. 158). Urbana, Ill.: The University of Illinois, Center for the Study of Reading, January, 1980.

Menzel, P. Linguistic bases of the theory of writing items for instruction stated in natural language. In J. R. Bormuth (Ed.), On the theory of achievement test items. Chicago: University of Chicago Press, 1970.

Paris, S. G. Integration and inference in children's comprehension and memory. In F. Restle, R. Shiffren, J. Castlelan, H. Lindman, & D. Pisone (Eds.), Cognitive theory, Vol. 1. Hillsdale, N. J.: Lawrence Erlbaum Associates, 1975.

Paris, S. G., & Carter, A. Y. Semantic and constructive aspects of sentence memory in children. Developmental Psychology, 1973, 9, 109-113.

Paris, S. G., & Upton, L. R. Children's memory for inferential relationships in prose. Child Development. 1976, 47, 660-668.

Pearson, P. D. The effects of grammatical complexity on children's comprehension, recall, and conception of certain semantic relations. Reading Research Quarterly, 1974-75, 10, 155-192.

Pearson, P. D., Hansen, J., & Gordon, C. The effect of background knowledge on young children's comprehension of explicit and implicit information. (Tech. Rep. No. 116). Urbana, Ill.:

The University of Illinois, Center for the Study of Reading, March, 1979.

Pichert, J. W., & Anderson, R. C. Taking different perspectives on a story. (Tech. Rep. No. 14). Urbana, Ill.: The University of Illinois, Center for the Study of Reading, November, 1976.

Robertson, J. E. Pupil understanding of connectives in reading. Reading Research Quarterly, 1968, 3, 386-417.

Rumelhart, D. E. Toward an interactive model in reading. In Attention and Performance VI: Proceedings of the Sixth International Symposium in Attention and Performance, Stockholm, Sweden, July 28-Aug. 1, 1975. Hillsdale, N. J.: Lawrence Erlbaum Associates, 1975.

Schallert, D. L. Improving memory for prose: The relationship between depth of processing and context. (Tech. Rep. No. 5). Urbana, Ill.: The University of Illinois, Center for the Study of Reading, November, 1975.

Spiro, R. J. Inferential reconstruction in memory for connected discourse. (Tech. Rep. No. 2). Urbana, Ill.: The University of Illinois, Center for the Study of Reading, October, 1975.

Standal, T. C. The effects of syntactic, semantic, and contextual variations on children's comprehension and recall of causal relations. Doctoral dissertation, University of Minnesota, 1976. (University Microfilms No. 77-12, 859).

Steffenson, M. S., Joag-dev, C., & Anderson, R. C. A

cross-cultural perspective on reading comprehension. (Tech. Rep. No. 97). Urbana, Ill.: The University of Illinois, Center for the Study of Reading, July, 1978.

Sulin, R. A., & Dooling, D. J. Intrusion of a thematic idea in retention of prose. Journal of Experimental Psychology, 1974, 103, 255-262.

Thorndyke, P. W. Cognitive structures in human story comprehension and memory. Doctoral dissertation, Stanford University, 1975. (ERIC Document Reproduction Service No. ED 123587).

Thorndyke, P. W. The role of inferences in discourse comprehension. Journal of Verbal Learning and Verbal Behavior, 1976, 15, 437-446.

Figure 1

Design Matrix of the Three Way Factorial Study

CONTEXT (B)		SEMANTIC CONTENT (A)											
		Easy									Difficult		
		A01	A02	A03	A04	A05	A06	A07	A08	A09	A10	A11	A12
B1 Sent.	C1 Synt. (C) C2												
B2 Pict.	C1 Synt. (C) C2												
B3 Para.	C1 Synt. (C) C2												

Sent. - Sentence
Pict. - Picture
Para. - Paragraph
Synt. - Syntax

Table 1

Means of Correct Inferential Responses for Semantically Easy Structures Grouped by Content, Context, and Syntax

	Context 1			Context 2			Context 3			
Topics	Syn. 1	Syn. 2	Sub-Total	Syn. 1	Syn. 2	Sub-Total	Syn. 1	Syn. 2	Sub-Total	Total
Airplane	.96	.96	.960	1.00	1.00	1.00	.92	.96	.940	.966
Ice Cream	.92	1.00	.960	1.00	.96	.98	1.00	.92	.960	.966
Phonograph	.67	.71	.690	.96	1.00	.98	1.00	.96	.980	.883
Carousel	.50	.50	.500	.67	.75	.71	.46	.67	.565	.592
Vending Machine	.96	1.00	.980	.92	.92	.92	.75	.75	.750	.883
Elephant	.88	.71	.795	.92	.92	.92	.92	1.00	.960	.864
$\bar{X}$	.815	.813	.814	.912	.925	.918	.841	.877	.859	.864

Semantically Easy Content
$\bar{X}$ = .864

Context 1
$\bar{X}$ = .814

Context 2
$\bar{X}$ = .918

Context 3
$\bar{X}$ = .859

Syntax 1
$\bar{X}$ = .856

Syntax 2
$\bar{X}$ = .871

Context 1 = Sentence Context 2 = Picture Context 3 = Paragraph
Syntax 1 = 2 Simple Sentences with No Causal Connective
Syntax 2 = 1 Complex Sentence with Causal Connective
Note: Answers were Scored "1" = Correct, "0" = Incorrect

Table 2

Means of Correct Inferential Responses for Semantically Hard Structures Grouped by Content, Context, and Syntax

	Context 1			Context 2			Context 3			
Topics	Syn. 1	Syn. 2	Sub-Total	Syn. 1	Syn. 2	Sub-Total	Syn. 1	Syn. 2	Sub-Total	Total
Bagpipe	.04	.00	.020	.42	.46	.440	.12	.04	.080	.180
Ship Christening	.04	.04	.040	.04	.04	.040	.38	.29	.335	.138
High Jump	.00	.08	.040	.71	.79	.750	.54	.67	.605	.465
Arm Wrestling	.21	.29	.250	.88	.96	.920	.71	.71	.710	.627
Kite	.42	.15	.285	.79	.96	.875	.50	.58	.540	.566
Mobile	.12	.21	.165	.33	.33	.330	.17	.21	.190	.228
$\bar{X}$	.139	.128	.133	.528	.590	.559	.403	.416	.410	.367

Semantically Hard Content
$\bar{X}$ = .367

Context 1
$\bar{X}$ = .133

Context 2
$\bar{X}$ = .559

Context 3
$\bar{X}$ = .410

Syntax 1
$\bar{X}$ = .356

Syntax 2
$\bar{X}$ = .378

Context 1 = Sentence Context 2 = Picture Context 3 = Paragraph
Syntax 1 = 2 Simple Sentences with No Causal Connective
Syntax 2 = 1 Complex Sentence with Causal Connective
Note: Answers were scored "1" = Correct, "0" = Incorrect

Table 3

Means of Correct Literal Responses for Semantically Easy Structures Grouped by Content, Context, and Syntax

	Context 1			Context 2			Context 3			
Topics	Syn. 1	Syn. 2	Sub-Total	Syn. 1	Syn. 2	Sub-Total	Syn. 1	Syn. 2	Sub-Total	Total
Airplane	.92	.88	.900	.88	1.00	.940	.92	.75	.835	.892
Ice Cream	.96	1.00	.980	1.00	.96	.980	1.00	1.00	1.000	.986
Phonograph	.92	.96	.940	.96	.92	.940	.92	.92	.920	.933
Carousel	1.00	.92	.960	.96	.96	.960	.79	.92	.855	.925
Vending Machine	.96	1.00	.980	.96	.96	.960	1.00	.92	.960	.966
Elephant	1.00	.96	.980	1.00	1.00	1.000	.79	1.00	.895	.958
$\bar{X}$	.960	.953	.956	.960	.966	.963	.903	.918	.911	.943

Semantically Easy Content
$\bar{X}$ = .943

Context 1
$\bar{X}$ = .956

Context 2
$\bar{X}$ = .963

Context 3
$\bar{X}$ = .911

Syntax 1
X = .941

Syntax 2
X = .946

Context 1 = Sentence Context 2 = Picture Context 3 = Paragraph
Syntax 1 = 2 Simple Sentences with No Causal Connective
Syntax 2 = 1 Complex Sentence with Causal Connective
Note: Answers Were Scored "1" = Incorrect, "0" = Incorrect

Table 4

Means of Correct Literal Responses for Semantically Hard Structures Grouped by Content, Context, and Syntax

	Context 1			Context 2			Context 3			
Topics	Syn. 1	Syn. 2	Sub-Total	Syn. 1	Syn. 2	Sub-Total	Syn. 1	Syn. 2	Sub-Total	Total
Bagpipe	.88	.83	.855	.96	1.00	.980	.50	.42	.460	.765
Ship Christening	.71	.75	.730	.62	.71	.665	.67	.75	.710	.702
High Jump	.88	.92	.900	.92	.92	.920	.92	.92	.920	.913
Arm Wrestling	.83	.88	.855	.75	.92	.835	.58	.58	.580	.757
Kite	.88	.92	.900	.96	.88	.920	.71	.79	.750	.857
Mobile	.83	1.00	.915	.92	.96	.940	.96	.88	.920	.925
	.835	.883	.859	.855	.898	.877	.723	.723	.723	.819

Semantically Hard Content
$\bar{X}$ = .819

Context 1
$\bar{X}$ = .859

Context 2
$\bar{X}$ = .877

Context 3
$\bar{X}$ = .723

Syntax 1
$\bar{X}$ = .804

Syntax 2
$\bar{X}$ = .834

Context 1 = Sentence Context 2 = Picture Context 3 = Paragraph
Syntax 1 = 2 Simple Sentences with No Causal Connective
Syntax 2 = 1 Complex Sentence with Causal Connective
Note: Answers were Scored "1" = Correct, "0" = Incorrect

Table 5

Means of Correct Literal Responses and Correct Inferential Responses to the Literal Question

Topic	Correct Literal Response	Correct Literal Response Which Included an Inference
	Semantically Easy Structures	
Airplane	.892	.487
Ice Cream	.986	.640
Phonograph	.933	.040
Carousel	.925	.116
Vending Machine	.966	.020
Elephant	.958	.103
$\bar{X}$	.943	.234
	Semantically Difficult Structures	
Bagpipe	.765	.033
Ship Christening	.702	.040
High Jump	.913	.075
Arm Wrestling	.757	.041
Kite	.857	.150
Mobile	.925	.406
$\bar{X}$	.819	.124
	Total Means	
	.881	.179

Table 6

Analysis of Variance - Inferential Measure
As the Dependent Variable

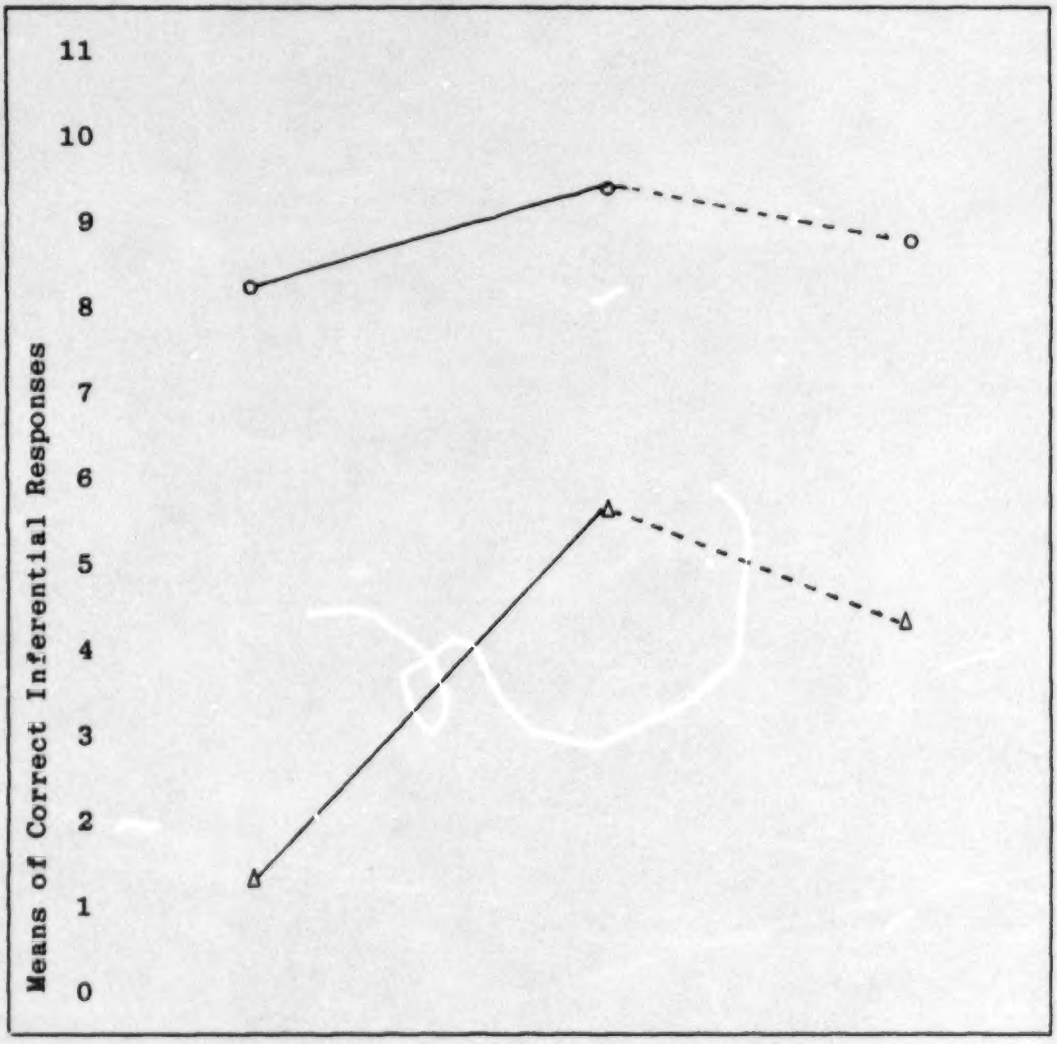
Source	SS	df	MS	F
Subjects	28.54	143	.20	1.26*
Semantic Content				
Difficulty	104.53	1	104.53	659.03**
Other	46.86	10	4.69	29.57**
Context				
1 vs 2	19.53	1	19.53	123.13**
3 vs (1 + 2) /2	.26	1	.26	1.64
Syntax	.21	1	.21	1.32
Difficulty by Context				
Difficulty by 1 vs 2	7.03	1	7.03	44.32**
Difficulty by 3 vs (1 + 2) /2	.42	1	.42	2.65
Difficulty by Syntax	.01	1	.01	< 1.00
Syntax by Context				
Syntax by 1 vs 2	.09	1	.09	< 1.00
Syntax by 3 vs (1 + 2) /2	.00	1	.00	< 1.00
Difficulty by Content by Syntax	.09	2	.04	< 1.00
ERROR	247.91	1563	.16	
TOTAL	408.62	1727		

*p < .05

**p < .01

Figure 2

Graph of the Semantic Difficulty by Context Interaction on the Inferential Measure



Appendix A

PILOTED TARGET STRUCTURES

1. Because the needle was old, the music was scratchy.
2. Because the tip was covered, the shaft did not penetrate.
3. Because the washer was worn, the water leaked.
4. Because the wind was blowing, the shot was short.
5. Because the bird was hit, it could not fly.
6. Because Randy hit the donkey hardest, the candy poured to the ground.
7. Because the door was left open, the bird flew away.
8. Because the wind blew, Mike pulled back.
9. Because the bubble burst, Mary's face was sticky.
10. Because the pin was thrown too high, he missed the catch.
11. Because the web was across the door, John stepped back.
12. Because the "eyes" could be seen, the children would not leave.
13. Because the sign read CLOSED, the children didn't get any ice cream.
14. Because the flag was thrown, the outcome was uncertain.
15. Because the signal was down, the car stopped.
16. Because the whistle blew, Mary turned the fire off.
17. Because the log was slippery, Charles fell off.
18. Because Tom's heel was too low, he lost the medal.
19. Because Jim hit the ribbon first, he won the medal.

20. Because the bottle didn't break, the trip was delayed (Bransford and McCarrell, 1974).
21. Because one hand was broken, John couldn't tell the time.
22. Because the mouth was broken, the nut could not be cracked.
23. Because the dog obeyed every command, he came in first.
24. Because the window was wide open, the birds moved.
25. Because some keys were jammed, the letter could not be finished.
26. Because he put on the crooked nose, the children laughed.
27. Because the blade was dull, he nicked his face.
28. Because Joe's elbow was raised, the contest ended.
29. Because the thorn was sharp, the florist hurt his finger.
30. Because the stick cracked, the boy fell down.
31. Because they were taking off, all seat belts were fastened.
32. Because the skirt was stained, the soldier couldn't march.
33. Because Bob didn't get his change, he kicked the machine.
34. Because the trunk was long, the peanut could be reached.
35. Because Jane stepped on the skin, she fell down.
36. Because the horse stopped in midair, the child had to climb down.
37. Because the bars were on the mask, the ball did not hurt.
38. Because the seam split, the note was sour (Bransford and McCarrell, 1974).
39. Because the electricity was off, the clothes could not be dried.

40. Because the spring was broken, the clown did not come out.

41. Because the tongue was crooked, Carol's foot hurt.

42. Because the corkscrew bent, ice tea had to be served.

43. Because the air became still, the craft could not move.

44. Because the wheel spun off center, the pot was crooked.

45. Because the coin did not fit in the slot, the child did not get his treat.

46. Because the patch ripped suddenly, John sank.

47. Because the glue wouldn't stick, the letter fell out.

48. Because the windows were closed, the room became cool.

Appendix B

SAMPLE PASSAGE

Target Structure

Because the horse stopped in mid-air, the child had to climb down.

OR

The horse stopped in mid-air. The child had to climb down.

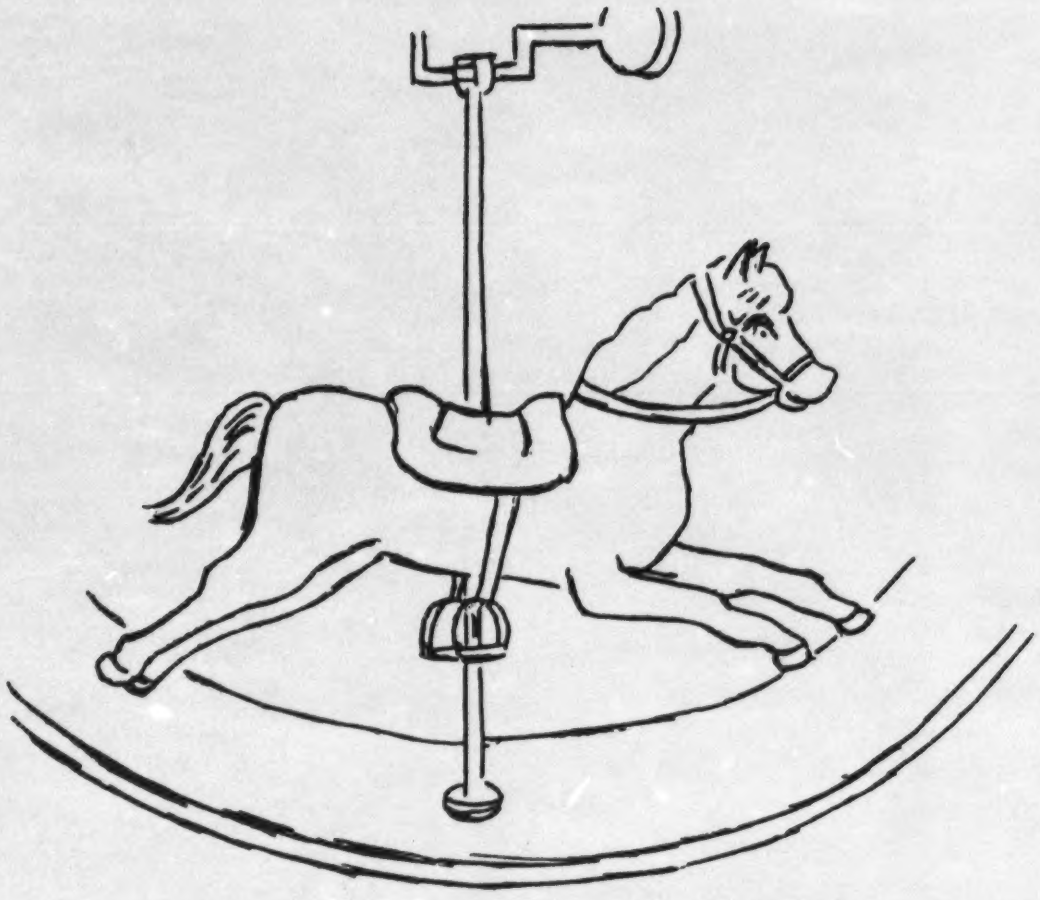
Passage

The little girl was sitting on a blue horse. It was brightly painted, and its hair was carved to look like it was blown by the wind. The horse seemed to keep time to the music. It went up and down and around in the circle. Slowly the music and the horse stopped. Because the horse stopped in mid-air, the child had to climb down. Her father was standing behind a fence. He jumped on the ride to help the child off the horse. Then they both got off. The music and the horses started again.

Comprehension Questions

Literal: Why did the child have to climb down?

Inferential: What was the child on? What kind of horse was it?



Appendix C

BAGPIPE PASSAGE

Target Structure

Because the seam split, the note was sour.

OR

The seam split. The note was sour.

Passage

MacGregor was surprised at the sound he just heard. Something awful had happened. Because the seam split, the note was sour. Just a minute before, MacGregor had been parading around the castle entertaining tourists with his instrument. He had been dressed in his kilts, and he had been keeping time to the wailing music of his instrument. Then he had heard his instrument sound off-key. Many people giggled and laughed. MacGregor was embarrassed. He left to see what could be done to repair his instrument.

Comprehension Questions

Literal: Why was the note sour?

Inferential: What was MacGregor playing?